Columbia Space Shuttle Debris Recovery
Flight Operations Risk Assessment
Findings and Recommendations

The stated mission to recover Columbia Space Shuttle debris is neither time critical nor deemed essential to the immediate safety of the local populous like those encountered while fighting wildland fires. As such, the "essential" flight requirements and associated risks differ from those encountered while fighting these fires. As an example, the acceptable risks associated with delivering water to specific locations to save homes, livestock and personnel on the ground differ greatly with the acceptable risks associated with searching for Shuttle debris. In some instances, flight within the avoid range of the height/velocity curve (low & slow) over trees and non-level terrain (> 10 deg slopes, hillsides, cliffs, etc.) might be an acceptable risk in many instances while fighting wildland fires. In contrast, for this recovery effort flight within the avoid range of the height/velocity curve over trees, and non-level terrain must be mitigated on a mission-by-mission basis.

In broad terms, search operations will in every instance ensure the safe operation of helicopters and air attack aircraft from takeoff to landing. First and foremost, the following should be very clear to every flight crewmember …

> The intent is to search areas "clear" of trees that would prevent the safe landing (a safe landing is any landing from which all crewmembers can walk away) in the event of any aircraft emergency requiring an immediate landing.

In specific terms, search operations shall be conducted by ensuring the following guidelines are adhered to:

Aircraft and Pilots

- The aircraft shall have a current interagency card showing that the aircraft has been inspected and approved for the mission to be performed.
- The pilot must have a current interagency card showing qualifications for the mission to be performed.

Training

Helicopters

- Search techniques and expectations:
    - Grid Search Techniques (See Grid Search Section Below)
    - Pilot Expectations
        - Pilots are to devote 100% of their efforts to the safe operation of the helicopter … they are not to search for Shuttle debris (Single Pilot mindset).
    - Helicopter Manager (HCWN) Expectations
        - The primary duties of the HCWN are prescribed in chapter 2 of the IHOG. To summarize, he is to aid the pilot in clearing for flight hazards & coordinating search within the assigned grid. When primary duties allow, the HCWN may aid in the search for shuttle debris.

    - Helicopter Search Crewmember (NASA and/or Interagency Personnel) Expectations
        - Primary search aircrew.
        - Search methods and helicopter safety must be thoroughly understood before flight operations commence.
        - IMMEDIATELY call out any suspected hazard (wire, tree, livestock, wildlife, etc.)
        - Helicopter safety concerns briefing for non-helicopter experienced crewmembers will be conducted
            - Ensure coats that have been removed are secured prior to flight to prohibit it flying out of the cabin into tail rotor)
            - View helicopter flight safety video.

- The number of personnel (4 maximum) will remain within the performance capabilities of the airframe.
- Crew day expectations / Fatigue
    - Flight in the low-level search environment will be restricted to 1.5 hours between refueling cycles (not to include time transiting to and from grids).
    - Total search time will not exceed 4.5 hours per day.
    - Total flight time will not exceed 6.5 hours per day.

<u>Preflight Prep (Performance Planning, Crewmember Briefing)</u>

- Perform crew briefing in accordance with the IHOG and the daily aviation plan.
- Load calculations as prescribed by the IHOG and out of ground effect performance planning shall be utilized for low-level operations.
- A thorough crewmember safety briefing will be given before each flight in accordance with the IHOG (i.e. hazards associated with helo ops with doors removed, approach and departure paths, etc.).

<u>Transit To and From Search Grids</u>

- Transit from the helibase to search grids and between search grids & refueling locations will be accomplished at 1500’ MSL.
- Transit from search grids and refueling locations to the helibase will be accomplished at 1200’ MSL.

<u>Operations Between Clear Areas In Search Grids</u>

- Transitions within grids will be accomplished while maintaining altitude and airspeed commensurate with accomplishing a survivable emergency landing in the event of mechanical malfunction.

<u>Grid Search</u>

- As stated previously, the intent is to search areas “clear” of trees that would prevent a safe landing (a safe landing is any landing from which all crewmembers can walk away in the event of any aircraft emergency requiring an immediate landing).
- No “search” operations are to be conducted over areas where the trees (canopy) or terrain prevent the ability to clear said terrain to a 75% Probability of Detecting objects 12”x12” in size.

- A high and mid-level recon will be completed prior to commencing low-level search operations.
- A 20' minimum horizontal and vertical clearance from all obstacles will be adhered to (considered best altitude to keep the helicopter above the majority of potential obstacles while still enabling crew survivability upon landing in case of emergency).
- Unimproved Landing Areas
    - The helicopter will land to retrieve debris only in safe landing areas as determined by the pilot and the helicopter manager. All landing zones will be "In Ground Effect" with a minimum 15'x15' solid, level touchdown pad with minimum 75' safety circle clearance for rotor system. This determination will be in accordance with established rules for unimproved helispots.
    - If a determination is made to land, the pilot will state their intentions to the crewmembers on board and to the air tactical group supervisor for the assigned zone. All crewmembers will cease search operations and assist with the safe landing of the aircraft. The cockpit will become a sterile environment using all crew to communicate hazards to the pilot.
    - If it is determined that an item cannot be retrieved safely it will be marked on the map and the coordinates will be written on the data sheet for retrieval by ground forces.

Weather

- The mitigation measures previously in place are acceptable with the exception of …
    - Remove the "Icing" guidance for the Air-Attack aircraft from the Aircraft Operations Minimums as FAR guidance is sufficient.
    - Follow the aircraft VFR minimums sheet published per the aircraft operations plan.

Seat Belts &. Harnesses

- The mission shall not necessitate the utilization harnesses which allow crewmembers to hang beyond the helicopter airframe.
- No part of any individual or any item should be outside the airframe of the helicopter during flight.
- **Seat belt restraint is for crash survivability.** No tape or modification of any kind over the seat belt actuator is permitted ~~recommended~~. The belt should never be relied on to keep personnel in the aircraft under normal flight operations. As such, if accidental actuation of the seat belt actuator occurs, the individual should be seated firmly in their seat and belt actuation should be of no effect. Bottom line … the seat belt should not be relied on to keep personnel in the helicopter under normal operations (i.e. do not lean out against the belt and rely on it to keep you in the helicopter).

Feedback

- At the user level there must be an avenue in place to ensure the previously listed controls are implemented and effective. As such, a feedback capability from each end user (Pilot, Manager, and Searcher) will be implemented. The helibase manager will gather "Risk Mitigating" feedback from each helicopter flight crew at each helibase on a daily basis. The helibase manager will submit a daily written report of

all issues brought to their attention. This form must be signed off daily by the Operations Aviation Safety Officer, Air Operations Branch Director, Aviation Coordinator, Texas Forest Service Air Boss (Boo Walker) and the NASA Air Operations Officer. Fixed-wing issues will be brought forward from the ATGS directly to the Air Operations Branch Director. Each identified issue must be addressed in a timely manner (1 day if possible) and feedback given to the initiator. If issues, which effect overall operations are identified, prompt attention will be given to alleviate the problem.